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(56) Documents cited

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(58) Field of search

F1E

Selected US specifications from IPC sub-class F04F

## (54) Apparatus for mixing fluids

(57) A short length of pipe 10 is plumbed into a pipe 11 which pipe carries the first fluid. Nozzle 14 injects the flow of the first fluid through venturi tube 13. Annular chamber 15 surrounds the nozzle 14. Injection of the first fluid by the nozzle 14 through the venturi tube 13 draws the second fluid in through line 16 for mixing therewith. A control valve 17 to control the rate of addition of the second fluid, may be present in line 16. Fig. 2 shows apparatus for the mixing of three fluids with the first fluid. In Fig. 2 nozzles 14 and 20 act as venturi tubes.

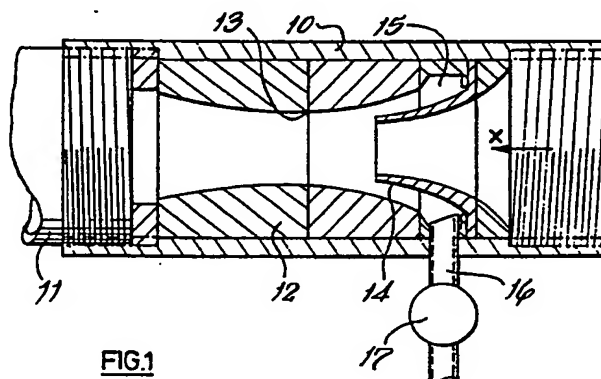


FIG. 1

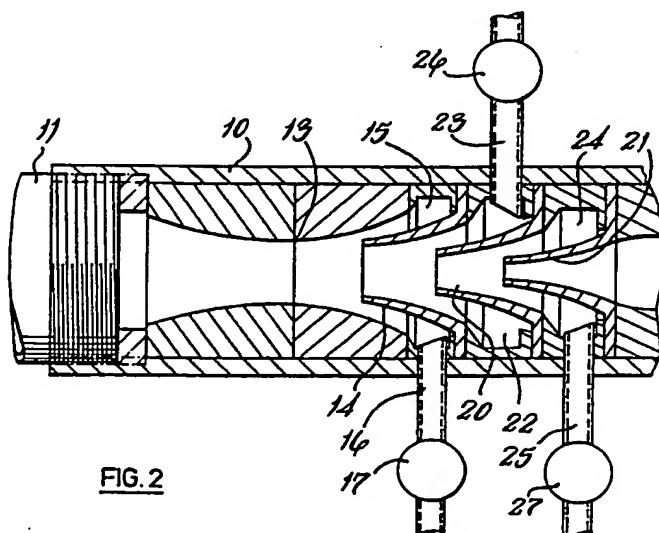
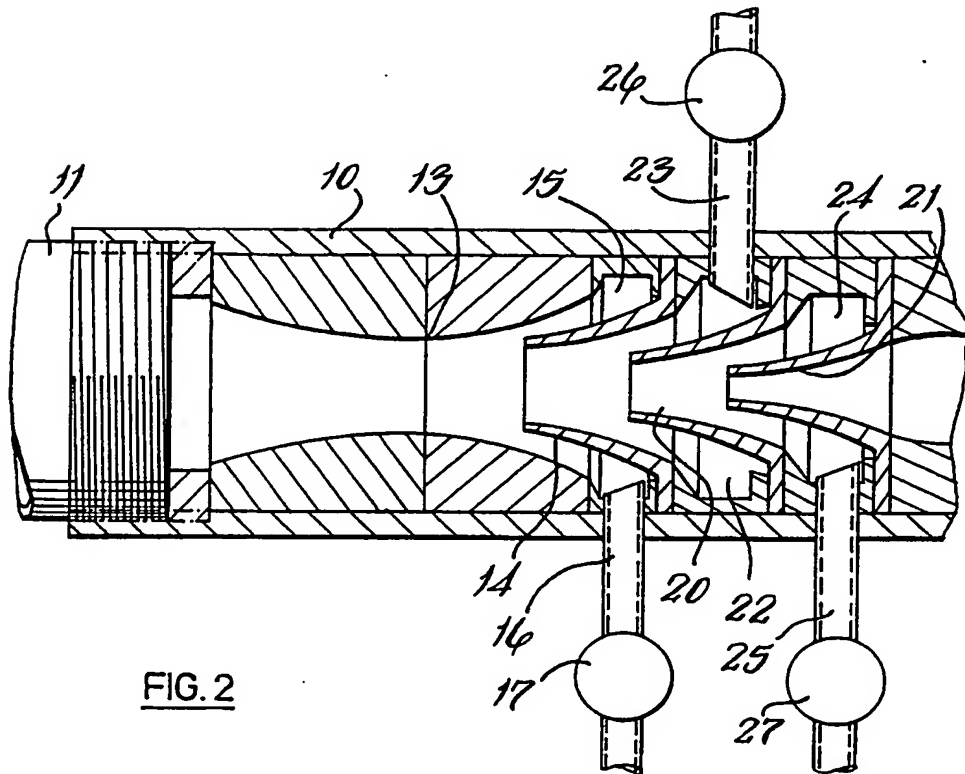
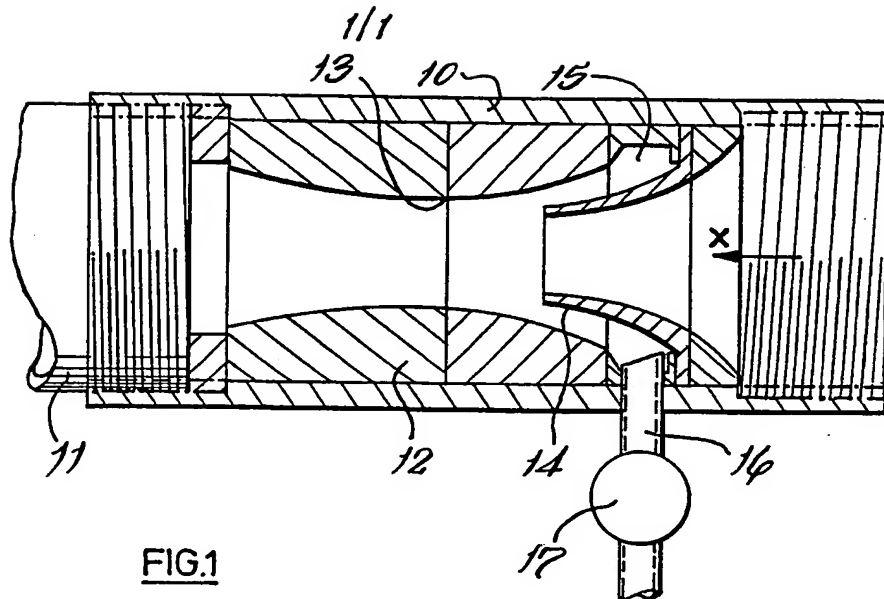


FIG. 2

The drawing(s) originally filed was/were informal and the print here reproduced is taken from a later filed formal copy.

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## SPECIFICATION

## Apparatus for mixing fluids

5 This invention concerns apparatus for mixing fluids, by which term we mean not only gaseous and liquid media, but also solids in finely divided form.

The number of processes wherein it is necessary to dose one fluid with another or others are legion. The addition of pesticides of one or more kinds to water for crop-spraying or foaming agents to water for fire-fighting or flavouring essences to water in the production of soft drinks, are but three examples.

According to the present invention there is provided apparatus for mixing fluids comprising a length of pipe adapted to be fitted into a flow-line along which a first fluid may flow, a portion of waisted section in said pipe forming a venturi tube, nozzle means for directing said first fluid through the venturi tube, a chamber within the pipe and surrounding the nozzle means and in communication with a source of a second fluid, whereby said second fluid is entrained by said first fluid as it passes through the pipe.

One or more further nozzle means each surrounded by a further chamber within the pipe and in communication with sources of further fluids may be provided, each such further nozzle means serving to direct said first fluid through the adjacent downstream nozzle which is shaped to form a venturi tube, all whereby one or more further fluids are entrained by said first fluid as it passes through the length of pipe.

Where there are a plurality of nozzle means they may be partially nested within one another.

Valve or like means may be provided to control the supply of the second and any further fluids to their respective chambers.

The invention will be further apparent from the following description, with reference to the several figures of the accompanying drawings, which show, by way of example only, two forms of mixing apparatus embodying same.

Of the drawings:—

50 *Figure 1* shows a longitudinal cross-section through a first form of apparatus for mixing two fluids; and

55 *Figure 2* shows a longitudinal cross-section through a second form of apparatus for mixing four fluids.

Referring firstly to *Fig. 1* it will be seen that the first form of apparatus comprises a short length of pipe 10 which is plumbed into the length of a flow line pipe 11 using conventional screw or similar connections. The flow line pipe 11 is adapted to carry a first fluid such as water in the direction of the arrow X.

At the downstream end of the pipe 10 is an insert 12 defining a waist forming within the pipe 10 a venturi tube 13.

Also within the pipe 10 is a nozzle member 14 which serves to inject the flow of the first fluid through the venturi tube 13.

Surrounding the nozzle means 14 and within the pipe 10 is an annular chamber 15 communicating, by way of line 16 entering the pipe 10 in a radial direction, with a source of a second fluid to be mixed with the first. As the first fluid is injected by the nozzle means 14 through the venturi tube 13 the second fluid is drawn in through the line 16 for admixture therewith. A control valve 17 may be included in line 16 to control the rate at which the second fluid is added to the first.

80 Referring now to *Fig. 2* it will be seen that the second form of apparatus includes all of the parts as described thus far and such are numbered with like reference numerals. In this embodiment there is provision for the mixing of two further additional fluids with the first fluid.

To this end two further nozzle means 20 and 21 are provided. The nozzle means 20 is of lesser diameter than the nozzle means 14 and the nozzle means 21 is of lesser diameter than the nozzle means 20. The three are partially nested within one another as shown in *Fig. 2*. The nozzle means 20 is surrounded by an annular chamber 22 in communication with a source of a third fluid by means of a line 23. The nozzle means 21 is surrounded by a still further annular chamber 24 in communication with a fourth source of fluid by means of a line 25. Valves 26 and 27 are provided in the lines 23 and 25 respectively to control the flow of the third and fourth fluids into the chambers 22 and 24.

Each nozzle means which is downstream from another nozzle means is so shaped as to act as a venturi tube, whereby as the first fluid passes through the flow line it is dosed with the second, third and fourth fluids in desired proportions.

It will be appreciated that it is not intended to limit the invention to the above example only, many variations, such as might readily occur to one skilled in the art, being possible, without departing from the scope thereof as defined by the appended claims.

## CLAIMS

1. Apparatus for mixing fluids comprising a length of pipe adapted to be fitted into a flow-line along which a first fluid may flow, a portion of waisted section in said pipe forming a venturi tube, nozzle means for directing said first fluid through the venturi tube, a chamber within the pipe and surrounding the nozzle means and in communication with a source of a second fluid, whereby said second fluid is entrained by said first fluid as it passes through the pipe.

2. Apparatus according to claim 1 having one or more further nozzle means each surrounded by a further chamber within the pipe

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and in communication with sources of further fluids each such further nozzle means serving to direct said first fluid through the adjacent downstream nozzle which is shaped to form a venturi tube, all whereby one or more further fluids are entrained by said first fluid as it passes through the length of pipe.

3. Apparatus according to claim 2 wherein the plurality of nozzle means are partially nested within one another.

4. Apparatus according to any preceding claim wherein valve or like means is provided to control the supply of the second and any further fluids to their respective chambers.

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#### CLAIMS

Amendments to the claims have been filed, and have the following effect:—

Claims 1 and 2 above have been deleted or textually amended.

New or textually amended claims have been filed as follows:—

1. Apparatus for mixing fluids comprising a length of pipe of constant diameter adapted to be fitted into a flow-line along which a first fluid may flow, an insert of waisted section fitted in said pipe and forming a venturi tube, a further insert defining nozzle means for directing said first fluid through said venturi tube, a still further insert defining a chamber within the pipe and surrounding the nozzle means and in communication with a source of a second fluid, whereby said second fluid is entrained by said first fluid as it passes through the pipe.

2. Apparatus according to claim 1 having one or more further inserts each defining nozzle means and each surrounded by a further insert defining a chamber within the pipe and in communication with sources of further fluids each such further nozzle means serving to direct said first fluid through the adjacent downstream nozzle which is shaped to form a venturi tube, all whereby one or more further fluids are entrained by said first fluid as it passes through the length of pipe.